Materials Engineering and Testing Services

2070 Controller

2070 Diagnostics Acceptance Test

Caltrans Version 1.5
User Manual
DRAFT

Table of Contents

Table of Contents (continued)

List of Figures

Introduction

Caltrans 2070 Diagnostics Acceptance Test (DAT)

The Caltrans 2070 DAT has been designed to provide functional testing of the major functions of the 2070 unit. It provides a suite of tests to verify proper operation of both the hardware components of the unit as well as proper operation of the OS-9 operating system.

The software has been designed as a set of test programs, each capable of running individually. A single menu function that binds all of the tests into a single module for performing tests from the 2070 Front Panel Assembly Display and using the 2070 Front Panel Assembly Keypads has also been provided.

Version 1.5 Software

Version 1.5 of the 2070 DAT software has been developed in the Microware Ultra C language using the Microware Hawk development system. Each program module has been developed to run on 2070 controllers with 8x40 displays only.

2 Getting Started

Installation

The Diagnostic Acceptance Tests (DAT) Caltrans Version 1.5 software comes pre-installed on the 2070 controller. The DAT parent test module, “dat” along with the individual test modules reside in the /DAT directory on the Flash ROM Drive /f0. Refer to the “Running Individual Tests” section of this manual for a complete listing of the individual test modules needed for DAT testing.

Starting the software

Script files have been written to enable the parent test module to be executed from both the terminal and from the Front Panel Assembly. Ensure that the script files titled, “termdat” and “fpadat” have been loaded onto the root directory of the /f0 drive first before executing each script. Additionally, the parent test module titled, “dat” must be loaded into the /DAT directory of the /f0 drive first before running either script. “Termdat” executes the DAT from the terminal and “fpadat” runs the DAT from the Front Panel Assembly. Typing either command at the OS-9 prompt will bring up the DAT.

Upon execution of the “termdat” command, the led on the FPA will start flashing and the screen formatted in Figure 1 is displayed.

```
        2070
Diagnostics Acceptance Test
   Caltrans Version 1.5


          DANGER!
DO NOT USE WHILE CONTROLLER IS
BEING USED FOR TRAFFIC CONTROL
OR SERIOUS DAMAGE, INJURY OR
       DEATH MAY OCCUR !!!


*** DAT Main Menu ***
1) Processor
2) Front Panel
3) Field I/O
4) Async Ports
5) Sync Ports
6) Modem Tests
7) Utility Functions
8) Run Continuous
9) Configure Standard Tests
```

Figure 1 – Startup screen run from the PC terminal

Selecting items from the main menu tells the validation suite to display submenus containing finer test details. For example, to run tests related to the 2070 processor, select 1. To run the DRAM Memory test, select 1 again. To go back to the previous menu, hit the ESC key. Hitting the ESC key at the main menu will terminate testing of the DAT in terminal mode.

When the DAT parent program is started with a script file, the DAT test results are presented in a standard PASSED/FAILED mode only. To display the test results in detail, verbose (extended display) mode must be specified. The parent test module must therefore be loaded manually from the terminal rather than via a script file. Simply type “dat -v” at the OS-9 shell prompt to execute all tests with this feature turned on. Figure 2 displays the output of the DRAM test selected for verbose mode.

```
Starting DRAM (/R2) Test
Total DRAM: 4194304
Free DRAM:  2884352
Testing   2869248 bytes @ $020f0000
Testing      4096 bytes @ $023c3f00
Testing      2304 bytes @ $023d2c00
Testing      2304 bytes @ $023d0b00
Testing      1792 bytes @ $023c2d00
Testing      1536 bytes @ $023bf000
Testing       768 bytes @ $02007f00
Testing       512 bytes @ $023d4700
Testing       512 bytes @ $023d1900
Testing       512 bytes @ $023d1600
Testing       512 bytes @ $023cfc00
Testing       256 bytes @ $023d5400
Testing        16 bytes @ $023ae8f0
PASSED DRAM (/R2) Test
```

Figure 2 –DRAM memory test run in terminal mode

As discussed earlier, to run the test on the Front Panel Assembly of the 2070 controller, the command “fpadat” must be executed at the OS-9 shell prompt. After execution of the command, the screen in Figure 3 is displayed on the front panel.

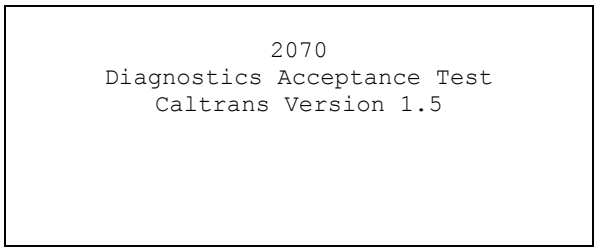

Figure 3 – Startup screen from the front panel

After a few seconds, the main menu screen shown in Figure 4 follows.

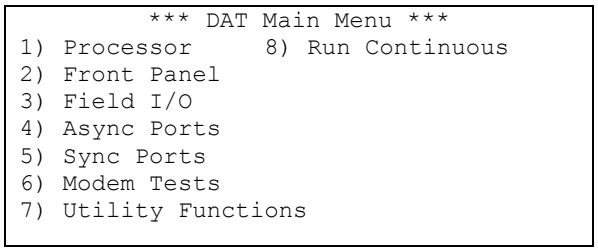

Figure 4 – Main menu screen from the front panel

Navigation around the DAT menus on the Front Panel Assembly is similar to navigation on the terminal. The difference is that now the inputs are read from the keypads on the FPA instead of from the computer's keyboard. Submenus and individual tests are selected using the indicated keys on the keypad. The ESC key is still used to go back one level, however, it cannot be used to exit the DAT. Testing in FPA mode can only be terminated from the terminal shell.

Running Individual Tests

The DAT software has been designed so tests can be run within the framework of the DAT menus or individually executed from the OS-9 terminal shell.

The available test program modules developed for the DAT are as follows:

dat	Parent program which will run other diagnostic tests and also includes small utility functions such as setting the date
chkr2	Initiates and tests the /R2 drive
chkr0	Tests the /R0 drive
chkf0	Tests the /F0 drive
chkmem	Tests the free memory

chkfio	Tests the field I/O using a loopback cable
chkser1	Checks the serial port using a single port loopback
chkser2	Checks the serial ports using a two port loopback
chkdisp	Checks the front panel display for proper operation
chkkeypd	Checks the keypad for proper operation
chkled	Flashes the LED on and off
chktmr	Check for proper timer operation (Not yet completed)
chkkey	Check for proper Datakey operation

Additionally the following modules and scripts have been included in order to test or configure the controller. They are not run by the parent DAT program, and must be run through the terminal shell

chkmod	Checks parity and CRC of boot image modules
chkled2	Allows you to manually turn on and off LED
fpadat	Script to start the DAT on the front panel (and starts logging) Note: fpadat should also be copied and renamed as startup if the /f0 directory on a new controller
termdat	Script to start the DAT on the terminal (and also starts logging)
antidat	Script to delete all test files from controller drives (*.tst)
startapp	Script to start Traffic Control Signal Program. Note that this script should be change if you are running another application other than the TSCP. The script should include: a. rename startup to datstartup b. rename application startup file to startup c. rename application OPEXEC to OPEXEC if required d. delete all .tst (test) files e. reboot the controller

To run a test individually, the module containing the test must be loaded into OS-9. This can be done using the OS-9 “load” command as follows substituting the test module name from the list above for <testmodule>:

```
$load -d /f0/DAT/chkfio
```

Once loaded, a test module can be executed by entering it’s name at the OS-9 Shell $ prompt. All tests run in their default modes return a standard PASSED/FAILED result.

For example, if you wanted to run the Field I/O Loopback test (module chkfio), you would type the following sequence at the OS-9 Shell $ prompt:

```
$load -d /f0/DAT/chkfio
$chkfio
```

Any test can be run to direct it's output and input to the Front Panel Assembly display and keyboard by redirecting the input and output to Serial Port 6 by adding "<>/SP6" to the command. For example, to execute the Field I/O Module Loopback Test from the example above and have the output displayed on the Front Panel Assembly display and accepts keys from the Front Panel Assembly keypads type:

```
chkfio <>/sp6&
```

Listed below are arguments that may be used when starting individual programs.

-b Basic mode - Does not test CTS/RTS/DCD (used on chkser1 and chkser2 only)
-l Enables error logging
-s Silent mode – No output to the screen
-v Verbose mode
-? Help

Test Suite Tree

Table 1 outlines the various tests that are available on the DAT from the Front Panel Assembly and from the terminal.

Table 1

Test Outline	Manual Section
MAIN MENU **1** PROCESSOR **1** DRAM (/R2) DRIVE **2** SRAM (/R0) DRIVE **3** FLASH (/F0) DRIVE **4** MEMORY TEST **5** TIMERS **6** DATAKEY **2** FRONT PANEL **1** DISPLAY **2** KEYBOARD **3** FIELD I/O **1** I/O LOOPBACK **4** ASYNC SERIAL PORTS **1** SP1 **2** SP2 **3** SP3 **4** SP4 **5** SP5 **6** SP8 **7** SP1<>SP2 **8** SP1<>SP3 **9** SP2<>SP3 **A** SP2<>SP4 **B** SP3<>SP4 **C** SP3<>SP5 **D** SP3<>SP8	

Test Outline	Manual Section
5 SYNC SERIAL PORTS **1** SP1S **2** SP2S **3** SP3S **4** SP5S **5** SP1S<>SP2S **6** SP1S<>SP3S **7** SP3S<>SP4S **8** SP3S<>SP5S **6** MODEM TESTS **1** SP1<>SP2 **1** SP1<>SP3 **1** SP2<>SP3 **7** UTILITY FUNCTIONS **1** TIME OF DAY FUNCTIONS **1** DISPLAY TOD CLOCK **2** SET TOD CLOCK **3** ENABLE DAYLIGHT SAVINGS **4** DISABLE DAYLIGHT SAVINGS **2** ETHERNET FUNCTIONS (NOT YET COMPLETE) **1** GET CURRENT IP ADDRESS **2** SET CURRENT IP ADDRESS **3** LOAD IP ADDRESS FROM DATAKEY **4** SAVE IP ADDRESS TO DATAKEY **5** START ETHERNET **3** CLEAR DAT ERROR LOG **4** CONFIGURE CONTINUOS TESTS **5** START TRAFFIC APPLICATION **8** RUN CONTINUOUS TESTS **9** CONFIGURE CONTINUOUS TESTS (Terminal mode only)	

3 Processor Tests

The Processor Tests section of the validation suite is designed to test the features and functions available on the 2070 CPU card. When option 1 is selected from the main menu, the sub-menu in Figure 5 is displayed.

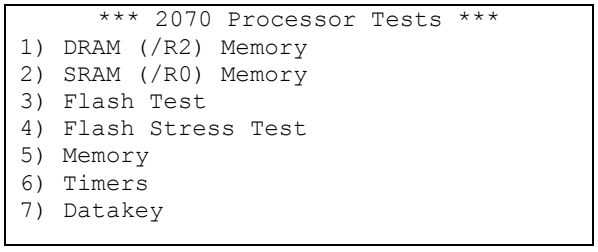

Figure 5 – Processor tests menu from the front panel

Individual tests are then selected using the indicated keys on the keypad. To return to the main menu, press ESC from this submenu.

DRAM Test

This test checks the total amount of dynamic RAM memory reported by OS-9 and the amount of dynamic RAM memory currently free on the /r2 drive. The test is performed by writing and checking a test pattern until all available memory has been tested.

A successful run of the DRAM test executed from the front panel is displayed in Figure 6.

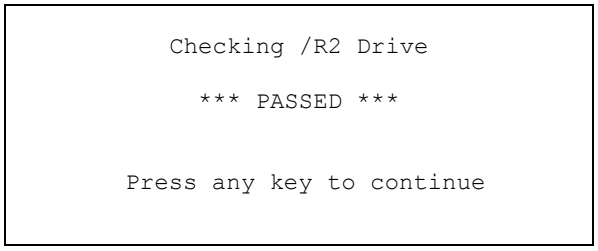

Figure 6 – Test result screen of a successful DRAM memory test run in FPA mode

SRAM Test

This test examines the /r0 drive and records the total amount of static RAM memory reported by OS-9 and the amount of static RAM memory space currently available on /r0.

A file is opened on the static RAM drive and written to until the drive is reported full by OS-9. The file is closed and reopened. The contents are then read back and checked against the pattern written.

The default mode of this test appears on the terminal and the FPA display as a standard PASSED/FAILED result. Figure 7 displays a test performed in terminal mode.

```
$ chkr0
Start: SRAM (/R0) Test
PASSED: SRAM (/R0) Test
```

Figure 7 – Running the SRAM memory test from the PC terminal in its default mode

Running the test in verbose mode produces the results shown in Figure 8.

```
$ chkr0 -v
Start: SRAM (/R0) Test
Total SRAM: 370688
Free SRAM:  212480
212992 bytes written to SRAM file
212992 bytes verified from SRAM file
PASSED: SRAM (/R0) Test
```

Figure 8 – SRAM memory test executed in verbose mode from the PC terminal

Flash Test

The flash test creates eight test files. It then writes to, reads from, and verifies all eight files one at a time before deleting them. When performing this test as part of a continuous testing loop, do not attempt to exit out of the loop under this test. Doing so will cause problems for the controller.

Figure 9 displays a fragment of the test executed in terminal mode. Only the first two test files are shown as an example.

```
$ chkf0 -v
 Start: SRAM (/R0) Test
PASSED: SRAM (/R0) Test$ chkf0 -v -l
Flash Drive (/f0) test
--- CREATING /f0/fdrvtst1 Test File 1
File /f0/fdrvtst1 created
--- WRITING test data to /f0/fdrvtst1
Write to /f0/fdrvtst1 file Succeeded
--- CREATING /f0/fdrvtst2 Test File 2
File /f0/fdrvtst2 created
--- WRITING test data to /f0/fdrvtst2
Write to /f0/fdrvtst2 file Succeeded
.
.
--- READING file contents of /f0/fdrvtst1
Read from /f0/fdrvtst1 file has finished
--- VERIFYING: Write/Read data -> Errors=0
--- DELETING Test File /f0/fdrvtst1
File /f0/fdrvtst1 Deleted

--- READING file contents of /f0/fdrvtst2
Read from /f0/fdrvtst2 file has finished
--- VERIFYING: Write/Read data -> Errors=0
--- DELETING Test File /f0/fdrvtst2
File /f0/fdrvtst2 Deleted

Flash Drive (/f0) Test -PASSED-
```

Figure 9 – Flash memory test executed in verbose mode from the PC terminal

Memory Test

This test performs two types of memory checks. The first test checks the total amount of memory and the amount of free memory available. It then performs 3 styles of memory testing using long word (32 bit), word (16 bit), and bytes (8 bit) to test the memory. Finally, it checks for any errors that occurred in the second test. Figure 11 shows the memory test executed in terminal mode.

```
$ chkmem -v
Starting memory test
Memory test type 1:
Total memory: 4193280
Free memory:  1944064
Testing   1912576 bytes @ $010cb000
Testing     12800 bytes @ $013b2e00
Testing      7936 bytes @ $013ca000
Testing      4096 bytes @ $013c8c00
Testing      4096 bytes @ $01006000
Testing      1792 bytes @ $013cd900
Testing       768 bytes @ $01005000
Testing        96 bytes @ $013d01a0
Memory test type 2:
 Requesting largest block of memory from OS9 Operating System.
   Memory Block pointer $010cb000, Memory Block size $001d2f00.
   Memory Test start address $010cb000, end address $0129df00
Installing BERR handler ... Done.
Performing 3 styles of memory testing:
 long word (32 bit) memory test
      word (16 bit) memory test
      byte ( 8 bit) memory test
 Total errors for test type 2 = 0
Memory test -PASSED-
```

Figure 11 – Running the memory test in verbose mode from the PC terminal

Timers Test

This test has not you been created, however when complete, this test will verify correct operation of the 2070 timers.

Datakey Test

This test has not you been created, however when complete, this test will verify correct operation of the 2070 Datakey.

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4 Front Panel Tests

The Front Panel Tests section of the validation suite is designed to test the features and functions available on the 2070 Front Panel Assembly. When option 2 is selected from the main menu, the submenu in Figure 12 is displayed.

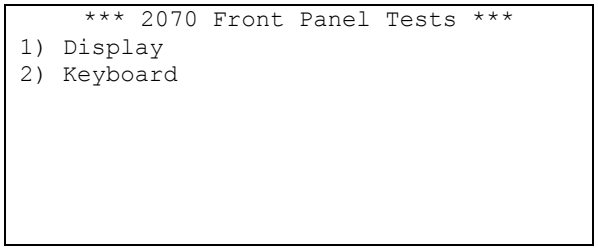

Figure 12 – Front panel tests menu in FPA mode

Display Test

The display test has been designed to demonstrate the capability of the 2070 Front Panel display to perform per the specification. It does this by performing a series of tests, which exercise feature codes available. The five tests included are the Features Display test, the Blank Screen test, the Fill Screen test, The Tab test, and the Speed test. These tests can be run from either the Front Panel Assembly or the terminal shell. It can be allowed to progress automatically from screen to screen every 30 seconds or manually by pressing any key on the keypad or keyboard.

The first screen displayed demonstrates the following display features:

- Carriage Return
- Line Feed
- Backspace
- Position Cursor at (x, y)
- Position Cursor Pn positions to right
- Position Cursor Pn positions to left
- Position Cursor Pn positions up
- Position Cursor Pn positions down
- Home cursor
- Compose Special Character
- Display Special Character
- Cursor off
- Turn character blink off
- Illuminate Backlight
- Extinguish Backlight
- Cursor Blink on
- Cursor Blink off
- Reverse Video on
- Reverse Video off
- Underline on
- Underline off
- All attributes off
- Cursor on

Figure 13 is an example of the display test being executed.

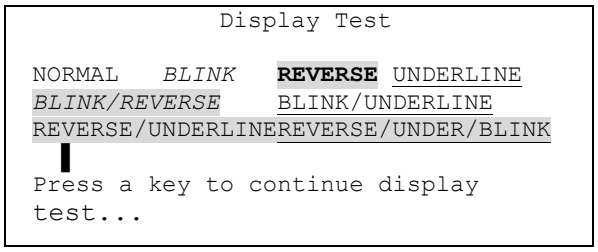

Figure 13 – First Screen of display test run from the front panel

Before this test moves to the next screen, the cursor cycles back and forth across the screen as the screen backlight is alternately illuminated and extinguished. After each cycle, the cursor switches from off, to on, to blinking and back to off for each subsequent cycle.

The next test performed is a blank screen test. This test is first announced by displaying Figure 14.

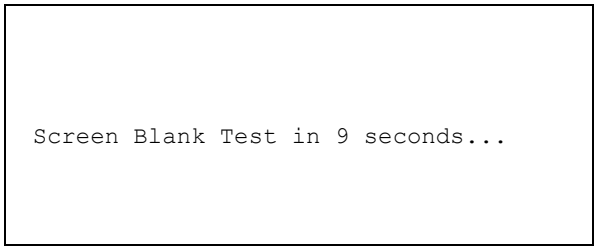

Figure 14 – Announcing the blank test from the front panel

When the timer on the screen counts down to zero, the screen is cleared demonstrating the following display features:

- Clear screen with spaces
- Auto scroll on
- Line Feed

The screen remains blank for 30 seconds or until a key is pressed.

The next test performed is to fill the screen completely. This test is first announced by displaying the screen in Figure 15.

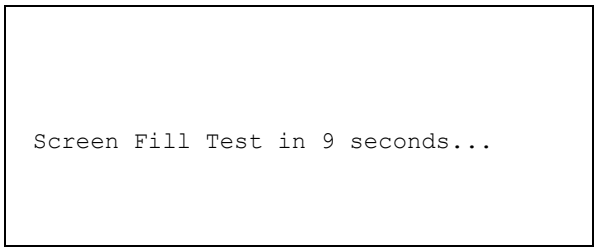

Figure 15 – Announcing the fill test from the front panel

Like the screen blank test, when the timer on the screen counts down to zero, the screen is filled with solid characters demonstrating the following display features:

- Compose Special Character
- Display Special Character
- Auto-Scroll off
- Auto-Wrap on
- Auto-Wrap off

The screen remains filled for 30 seconds or until a key is pressed.

The next test demonstrates the following display features:

- Move cursor to next tab stop
- Set tab at current cursor position
- Clear tab stop

During this test the screen in Figure 16 is displayed.

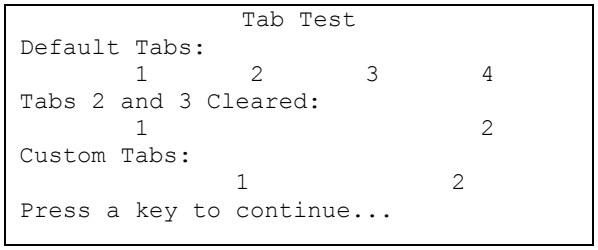

Figure 16 – Running the Tab test from the front panel

The default tabs demonstrate the initial tab positions defined in the display at power-up. Tab positions 2 and 3 are then cleared and two tab positions are then displayed demonstrating the cleared tab positions. All tab positions are cleared and two custom tab positions are created and displayed demonstrating that the original tab positions

were cleared and the new positions created. The Tab Test screen remains displayed until either a key is pressed or 30 seconds have elapsed.

The Speed test demonstrates the capability of the Front Panel Assembly Display to update every 50 milliseconds. The test is first announced as in Figure 17.

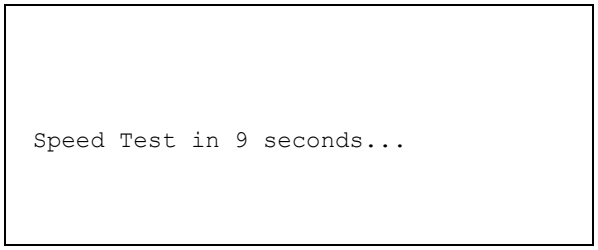

Figure 17 - Announcing the speed test from the front panel

The test then sets up a 50 ms OS-9 cyclic alarm. Each time the alarm expires, a counter is incremented and displayed in a 4-row by 3-column grid. The total output to the Front Panel Assembly is 176 bytes (45.83 ms.) every 50 ms allowing 4.17 ms of processing time for the task. The output looks as in Figure 18.

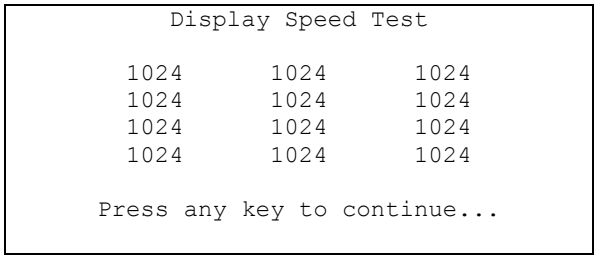

Figure 18 – Display test executed from the front panel

The test can be aborted at any time by pressing a key. The test automatically completes after 120 seconds if no key is pressed.

Finally, the display test performs a “soft reset” returning the display to its default settings and returns to the Front Panel Test submenu.

When the Display Test is executed from the terminal shell, the output of the test is sent to the FPA display and the terminal shell displays a screen similar to the following as in Figure 19.

```
$ chkdisp
Start: Display Test
Display Features Test...
 Screen Blank Test...
 Screen Fill Test...
 Tab Test...
 Start: Display Speed Test
 Soft Reset Test...
End: Display Test
```

Figure 19 – Terminal screen display of the display test executed from the PC terminal

Keyboard Test

The keyboard test is designed to demonstrate the features of the 2070 Front Panel keypad and also demonstrates several display functions that could be better demonstrated using keypad inputs. The following Front Panel Assembly features are demonstrated in this test:

- Status Cursor Position
- Set Backlight Timeout
- Auto-Repeat on
- Auto-Repeat off
- Bell

The test begins by inquiring the current status of the display thereby obtaining the current auto-repeat, backlight timeout, and AUX switch position indications. The screen in Figure 20 is then displayed.

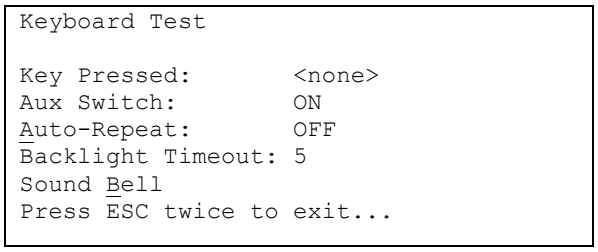

Figure 20 – Keyboard test executed from the front panel

The “Key Pressed” field is updated as keys are pressed on the keypad indicating which key was pressed. Each time the ‘A’ key is pressed, the auto-repeat feature is toggled on and off. Each time the ‘B’ key is pressed, the bell is sounded. The backlight timeout can be increased by pressing the up-arrow key and decreased by pressing the down-arrow key. The backlight timer is restarted after each change in the timeout. The position of the Auxiliary Switch on the front panel is tracked in the “Aux Switch” field.

This test does not time out automatically. Pressing the ‘ESC’ key twice consecutively terminates this test.

NOTE: Because the keyboard test requires access to the FPA keypads and operator intervention is required to perform the test, the Keyboard Test is not available in terminal mode nor is it available in continuous testing mode.

5 Field I/O Tests

I/O Loopback Test

The I/O Loopback test is designed to verify proper operation of the communications circuit between the 2070 CPU and the Field I/O Module as well as test the input and output circuitry on the Field I/O Module. In order to run this test, the Field I/O loopback connector must be installed in C1S and C11S.

To get to the Field I/O loopback test, select option 3 from the DAT main menu. The following screen is then displayed.

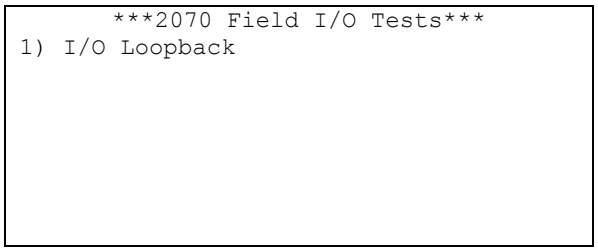

Figure 21 – Field I/O test menu from the front panel

Selecting 1 from this menu starts the Field I/O loopback test. The results are displayed as either PASSED or FAILED. Figure 22 shows the test run in FPA mode.

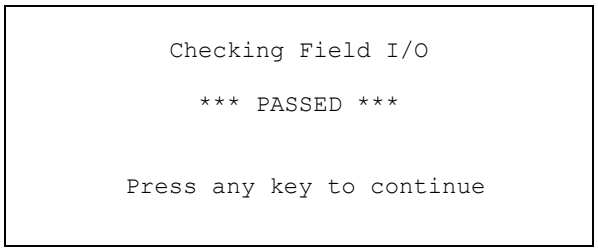

Figure 22 – Field I/O test executed from the front panel

When the program begins, it initializes by establishing communications with the Field I/O Module.

The program then begins sending a sequence of commands to first output a signal on a Field I/O Module output and then read back the status of all Field I/O Module inputs.

The input pin status is checked to make sure not only that the proper input is asserted, but also that all other inputs are not asserted. If either the proper input is not asserted, or an unexpected input is found asserted, the test fails reporting the failure.

6 Asynchronous/Synchronous Port Tests

Loopback Tests

The Async/Sync Port Tests section of the validation suite is designed to test the features and functions available on the 2070 Asynchronous and Synchronous Serial Ports. When option 4 is selected from the main menu, the Async submenu in Figure 23 is displayed:

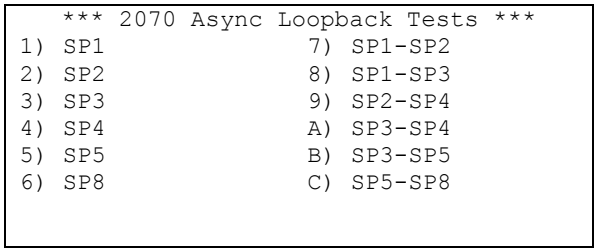

Figure 23 – Asynchronous tests menu from the front panel

The Sync Loopback Test submenu as displayed in Figure 24 can also be selected from the main menu under option 5.

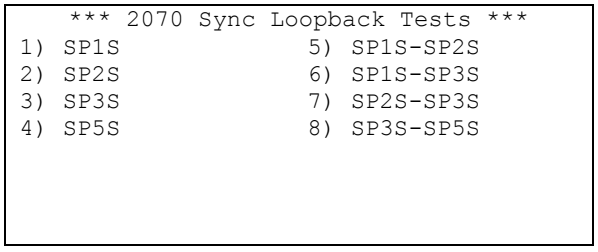

Figure 24 – Synchronous tests menu from the front panel

Single Port Loopback Tests

This test is accessed by selecting options 1 through 6 from the Async Loopback Tests submenu or by selecting options 1 through 4 from the Sync Loopback Tests submenu. Note that when serial port 4 (option 4) is selected for testing, the C50S connector must be removed first in order to undergo testing on this port.

This test checks for proper operation of individual serial communication ports. It begins by first opening a path to the port under testing and setting it to the preset flow control mode. If any other program is currently using the port, the test fails. This is to ensure that no conflicts exist for the hardware resource on the 2070.

In basic mode, the test writes a message from the transmitter to the receiver on the device and reads the message back. If the received message matches the sent message then the test passes. However, in extended mode, if the port has modem control signals, the CTS, DCD, and RTS lines are tested in addition to the transmit and receive lines. The RTS line is turned off upon initialization. The status of the CTS and DCD lines is then tested to be sure they also have been turned off. If either signal is on, the test fails.

The RTS line is then turned on. The status of the CTS and DCD lines is again tested to be sure they have also been turned on. If either signal is off, the test fails.

Finally, the RTS line on the port is turned off. The status of the CTS and DCD lines is once again tested to be sure they have also been turned off. If both signals have been turned off, the test passes and a message is generated.

Before testing, ensure that the correct loopback connector is installed on the port being tested. A run of the test in basic mode on /SP2 is shown in Figure 25.

```
$ chkser1 /sp2 -b -l
Start: Port Loopback Test
Port: /sp2
Comparing Messages...
PASSED: Loopback /sp2<->
```

Figure 25 – Single port loopback test executed in basic mode from the front panel with error logging enabled

The same test executed in verbose mode displays the following as in Figure 26.

```
$ chkser1 /sp2 -v -l
Start: Port Loopback Test
Port: /sp2
FCM:  0
/sp2 RTS: OFF  CTS: OFF  DCD: OFF
Raising RTS...
/sp2  RTS: ON   CTS: ON   DCD: ON
Transmitting.../sp2
Receiving.../sp2
256 bytes received
Comparing Messages...
RX = TX Message...
Lowering RTS...
/sp2  RTS: OFF  CTS: OFF  DCD: OFF
PASSED: Loopback /sp2<->
```

Figure 26 – Single port loopback test executed in verbose mode from the front panel with error logging enabled

Port<>Port Loopback Test

Selections 7 through D from the Async Loopback Tests submenu and selections 5 through 8 from the Sync Loopback Tests submenu are all port-to-port loopback tests. Before running any of these tests, be sure to disconnect any device already connected to the port being tested and connect the proper loopback connector assembly.

This test begins by first opening a path to each port under test. If any other program is currently using either port, the test fails. This is to ensure no conflicts exist for the hardware resources on the 2070.

While performing port-to-port tests, the control signal portions of the tests are performed only if both ports are control capable.

If the ports being tested have control signals available, the RTS on the first port is then turned off. The status of the CTS signal on the first port is then tested to be sure it has

also been turned off. The DCD line on the second port is also tested to be sure it has also been turned off. If either signal is on, the test fails and an appropriate message is generated.

The RTS line on the first port is then turned on. The status of the CTS signal on the first port and DCD signal on the second port are again tested to be sure they have also been turned on. If either signal is off, the test fails and an appropriate message is generated.

A 256-byte test message is then written from the transmitter on the first port to the receiver on the second port. A 256-byte read is then attempted from the receiver of the second port. If the read does not complete within one second, the test fails and an appropriate message is generated.

The test message received is then compared against the message that was sent. If they do not match, the test fails and an appropriate message is generated.

Finally, the RTS line on the first port is turned off. The status of the CTS signal on the first port and DCD signal on the second port are once again tested to be sure they have also been turned off. If either signal remains on, the test fails and an appropriate message is generated.

The test then repeats in the opposite direction.

The RTS on the second port is turned off. The status of the CTS signal on the second port is then tested to be sure it has also been turned off. The DCD line on the first port is also tested to be sure it has also been turned off. If either signal is on, the test fails and an appropriate message is generated.

The RTS line on the second port is then turned on. The status of the CTS signal on the second port and DCD signal on the first port are again tested to be sure they have also been turned on. If either signal is off, the test fails and an appropriate message is generated.

A 256-byte test message is then written from the transmitter on the second port to the receiver on the first port. A 256-byte read is then attempted from the receiver of the first port. If the read does not complete within one second, the test fails and an appropriate message is generated.

The test message received is then compared against the message that was sent. If they do not match, the test fails and an appropriate message is generated.

Finally, the RTS control signal on the second port is turned off. The status of the CTS signal on the second port and DCD signal on the first port are once again tested to be sure they have also been turned off. If both signals have been turned off, the test passes and a message is generated.

Figure shows a successful run of the port-to-port loopback test performed on /SP1 and /SP2 in terminal mode.

Shown below in Figure 27 is a successful run of this test in FPA mode.

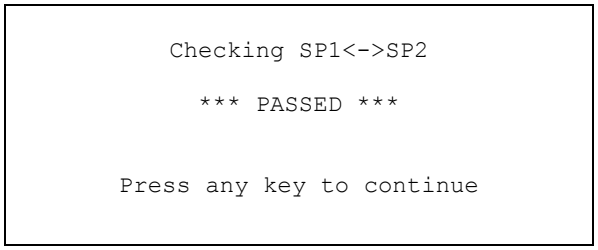

Figure 27 – Two-port loopback test executed from the front panel

7 Modem Tests

This test, used for testing modem communication on 2070-6A and 6B modems, is very similar to the Port to Port loopback test except that a modem loopback cable must be used.

This test begins by first opening a path to each port under test. If any other program is currently using either port, the test fails. This is to ensure no conflicts exist for the hardware resources on the 2070.

While performing port-to-port tests, the control signal portions of the tests are performed only if both ports are control capable.

The RTS on the first port is then turned off. The status of the CTS signal on the first port is then tested to be sure it has also been turned off. The DCD line on the second port is also tested to be sure it has also been turned off. If either signal is on, the test fails and an appropriate message is generated.

The RTS line on the first port is then turned on. The status of the CTS signal on the first port and DCD signal on the second port are again tested to be sure they have also been turned on. If either signal is off, the test fails and an appropriate message is generated.

A 256-byte test message is then written from the transmitter on the first port to the receiver on the second port. A 256-byte read is then attempted from the receiver of the second port. If the read does not complete within one second, the test fails and an appropriate message is generated.

The test message received is then compared against the message that was sent. If they do not match, the test fails and an appropriate message is generated.

Finally, the RTS line on the first port is turned off. The status of the CTS signal on the first port and DCD signal on the second port are once again tested to be sure they have also been turned off. If either signal remains on, the test fails and an appropriate message is generated.

The test then repeats in the opposite direction.

The RTS on the second port is turned off. The status of the CTS signal on the second port is then tested to be sure it has also been turned off. The DCD line on the first port is also tested to be sure it has also been turned off. If either signal is on, the test fails and an appropriate message is generated.

The RTS line on the second port is then turned on. The status of the CTS signal on the second port and DCD signal on the first port are again tested to be sure they have also been turned on. If either signal is off, the test fails and an appropriate message is generated.

A 256-byte test message is then written from the transmitter on the second port to the receiver on the first port. A 256-byte read is then attempted from the receiver of the first port. If the read does not complete within one second, the test fails and an appropriate message is generated.

The test message received is then compared against the message that was sent. If they do not match, the test fails and an appropriate message is generated.

Finally, the RTS control signal on the second port is turned off. The status of the CTS signal on the second port and DCD signal on the first port are once again tested to be sure they have also been turned off. If both signals have been turned off, the test passes and a message is generated.

8 Utility Functions

Time of Day Functions

The DAT has several functions, which allow you to set the 2070 clock, read the time of day, and to enable and disable the Daylight Savings function.

Display Time of Day (TOD) Clock

This utility displays the current date and time stored in the OS-9 system clock. It performs a check to see whether Daylight Savings Time (DST) is turned on or not. Then the status of the DST feature is returned and displayed onto the screen in addition to the TOD.

To bring up this utility function, select 7 from the main menu and then select 1 from the 2070 Utility functions submenu. The resulting front panel display should bring up a screen similar to the one depicted in Figure 28.

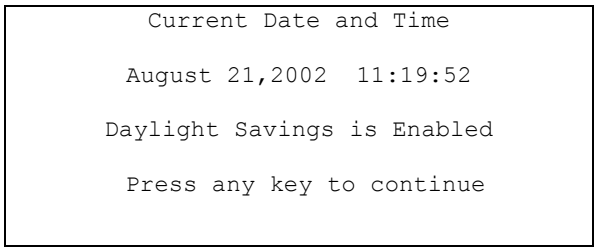

Figure 28 - TOD clock display from the front panel

Set Time of Day (TOD) Clock

The OS-9 TOD Clock can be set using either the OS-9 “setime” command available in terminal mode or by accessing the Set TOD Clock utility available under the Utility Functions submenu from the Front Panel.

To set the TOD clock from the Front Panel, select option 7 from the main menu. This brings up the 2070 Utility Functions submenu. Choosing option 2 from the submenu then brings up the utility function as depicted in Figure 29.

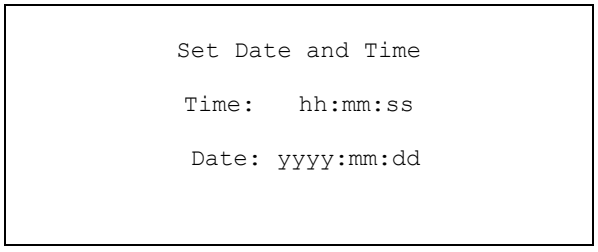

Figure 29 – Set TOD clock screen from the front panel

To set the TOD clock using the “setime” command, type the command at the OS-9 shell prompt as follows:

```
$ setime
```

The OS-9 shell will respond with the following prompt:

```
      yy/mm/dd hh:mm:ss [am/pm]
Time:
```

Entering the date and time formatted as indicated above sets the OS-9 internal clock to the specified date and time. Upon completion of the date and time entries, OS-9 displays the TOD clock back on the screen in the format shown below on line 4.

```
$ setime
            yy/mm/dd hh:mm:ss [am/pm]
Time: 02/09/06 09:10:00 am
September 6, 2002 Friday 9:10:00 am
```

Entering the date and time formatted as indicated sets the OS-9 internal clock to the specified date and time. The screen then automatically returns to the Utility Functions submenu after the date and time are entered. To abort the set TOD clock utility, press the ESC key.

Enable Daylight Savings Time (DST)

Daylight Savings Time begins on the first Sunday in April and ends on the last Sunday in October. The OS-9 DST clock should adjust accordingly to reflect these changes. The DST clock can be corrected to reflect these changes in time if it does not do so. Selecting option 3 from the 2070 Utility Functions submenu, which is selection 7 from the main menu, will set the DST clock to a value of 1, thereby enabling this feature. To double check that the DST clock flag is set, view the TOD clock under selection 1 of the Utility Functions submenu and check the status of DST.

Disable Daylight Savings Time (DST)

Selection 4 from the Utility Functions submenu will assign the DST clock a value of 0 therefore turning off DST. The status of DST should be double checked to ensure that it is off. The previous section on Enabling DST discusses the procedures for viewing the status of DST.

Ethernet Functions

The DAT will allow you to preform many basic Ethernet functions in order to allow the configuration and use of Ethernet on the 2070 lite.

Get Current IP Address

This function displays the current Ethernet address being used by the controller.

Set Current IP Address

This function allows the user to set the current IP address that the controller will use.

Load IP Address from Datakey

This function takes the IP address stored on the Datakey and sets it as the controllers IP address.

Save IP Address to Datakey

This function allows the user to save an IP address onto the Datakey.

Start Ethernet

This function initiates the Ethernet on the controller.

Clear DAT error log (daterrorlog)

The DAT error log file grows as errors are reported by the DAT validation suite and should periodically be reviewed and deleted to prevent the static RAM drive, /r0 from running out of storage. The DAT error log can be cleared under option 3 of the Utility Functions menu.

Configure Continuous Tests

This utility is one of the two methods that tests can be selected for continuous testing. Section 9 on Continuous Testing briefly discusses this utility along with another method for configuring standard tests.

This utility is selection 6 from the Utility Functions submenu. This selection brings up the Continuous Select Main Page, which is categorized into three separate pages:

1) Processor / FIO
2) Asynchronous Ports
3) Synchronous Ports
4) Modems

Selection of each page brings up the specific tests available in that category. Each test can then be selected by pressing the indicated number. An asterisk (*) will appear next to each test selected for continuous testing. Pressing the same test number again will cancel the selection for that specific test. The ESC key can be used to go back to the Continuous Select Main Page to proceed with choosing other tests. Repeat this procedure until all tests desired for continuous testing are selected. Figure 30 is an example of tests selected for execution from the Processor / Field I/O submenu in FPA mode.

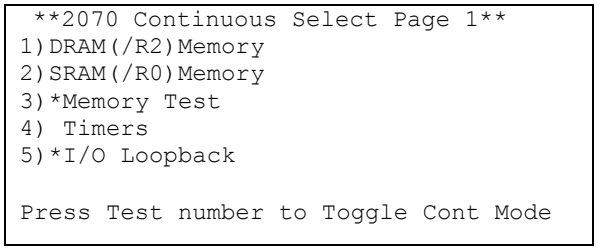

Figure 30 –Front panel selection menu for Processor / FIO continuous tests

In this example, the memory and field I/O loopback tests are flagged to be placed in a continuous test loop when the test is initiated.

To start continuos test select Run Continuos, selection number 8 from the main menu. The press the Yes key (or y key from the terminal) to start the tests. An example of the test running is shown below.

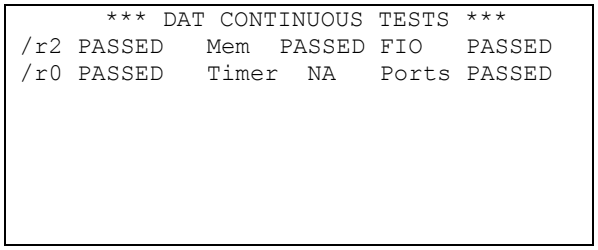

Figure 31 –Continuos Test Running on Front Panel

Start Traffic Application

When selected, this utility completely stops the DAT and causes the system to reboot with the Traffic Control Signal Program application running.

9 Continuous Testing

The DAT provides the capability to run individual tests in a continuous testing loop. This is done in a two-step process first selecting the tests to run in the loop and then initiating the continuous testing loop. When the DAT is executed from the Front Panel, there is only one method available for the selection of tests for continuous testing. However when the DAT is executed from the terminal, there are two methods available for selecting tests for continuous testing.

The Configure Continuous Tests Utility is the only way to select tests for testing in continuous mode while testing in FPA mode. This utility can be accessed through the following sequence of key entries: First select Utility Functions (option 7) from the main menu, then select Configure Continuous Tests (option 6) from the submenu. This screen brings up the Continuous Select Main Page, which further divides the tests into three separate pages. See the previous section on configuring continuous tests for a more detailed description.

In addition to the method discussed above, an alternate method exists for configuring continuous tests when the DAT is executed in terminal mode. This is done by selecting Configure Standard Tests (option 9) from the main menu. A screen similar to that in Figure is then brought up. The test number can then be used to toggle back and forth between selections. A new menu is brought up on the screen and updated each time a test number is pressed. Figure3 1 shows the SRAM Memory, Field I/O loopback, and sp1<->sp2 asynchronous loopback tests selected for continuous mode testing.

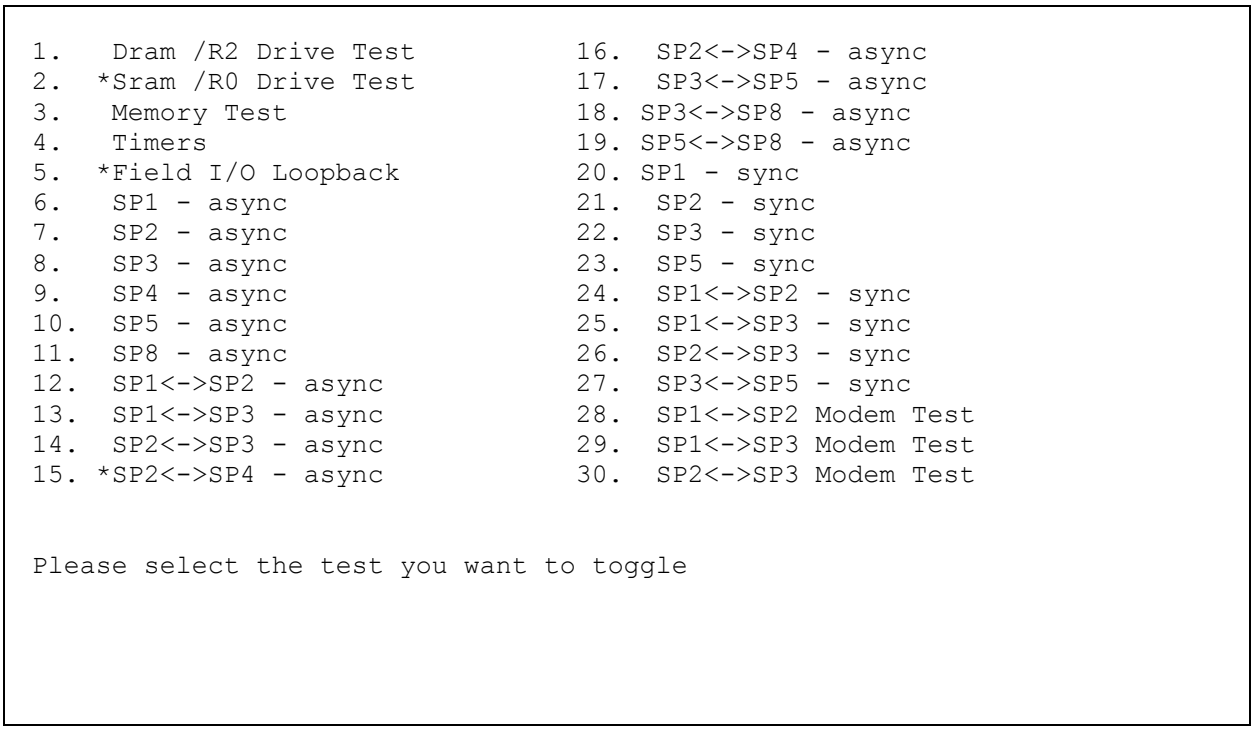

Figure 32 – Selection menu for continuous testing from the PC terminal

To initiate the continuous test loop, return to the main menu and select option 8 followed by YES on the FPA or Y on the terminal to begin the testing loop. Any other key aborts the request and returns to normal operation.

Once continuous loop testing has been initiated, pressing the ESC key terminates the continuous loop at the end of the current test and returns the DAT to normal menu operation.

10 Error Logging

In order to demonstrate the error logging capabilities of the 2070, all modules have been programmed with an option to send the results of testing to the OS-9 error handling routine. When running the parent program or individual tests in terminal mode, including a "-l" on the command line sends the errors that occurred during testing to the error log file "daterrorlog" on the /r0 drive. When running in FPA mode, the error logging option is automatically enabled.

The DAT error log file can be accessed using the standard OS-9 list utility. First, make sure you are in the /r0 directory. Type the command "chd /r0" to change the current directory to the /r0 drive. Then type the following command at the OS-9 Shell $ prompt:

```
list daterrorlog
```

The error log file will display a screen similar in format to that of Figure 32.

```
$ list daterrorlog
2002/08/28,11:00:58    chdmod test -FAILED- modchk Test# 1: P=Good CRC=Bad
in sp360h
2002/08/28,11:01:02    Field I/O Test -FAILED- chkfio:fioRead Err:1817
Rcv$dead
Exp$bc
2002/08/28,11:01:07    Serial Port Test (2 port) FAILED: Unable to raise CTS
on
/sp2
2002/08/28,11:01:12    chdmod test -FAILED- modchk Test# 1: P=Good CRC=Bad
in sp360h
2002/08/28,11:01:15    Field I/O Test -FAILED- chkfio:fioRead Err:1817
Rcv$dead
Exp$bc
2002/08/28,11:01:21    Serial Port Test (2 port) FAILED: Unable to raise CTS
on /sp2

2002/09/16,22:29:25    Serial Port Test (1 port) FAILED: setting FCM: 208
2002/09/19,22:01:36    Field I/O test -FAILED- chkfio:IOLoopBack@O=[0] Err:-
19 R
```

Figure 33 – DAT error log viewed from the PC terminal

11 Loopback Wiring Diagriam